DEVELOPING THE SOLDIER SYSTEMS ARCHITECTURE

COL Theodore Johnson

Army transformation, incorporating revolutionary employment concepts and cutting-edge technology, creates significant challenges not only for program managers who support it, but also for those who must meet today's user requirements. Project Manager (PM), Soldier Systems employs the "soldier-as-a-system" concept, along with a soldier systems architecture, to address current requirements and establish a strong foundation for transformation to the Objective Force.

The soldier systems architecture is a framework that considers required functions, establishes system modularity, and specifies internal and external interfaces among system modules that are integrated into a variety of platforms to satisfy the soldiers' needs. This architecture relies on commonality—for functions, modular components, and module interfaces—that applies to a series of warrior (soldier) platforms. For example, instead of producing a component uniquely designed for the infantry rifleman, we develop modules applicable to all types of infantry that can also be used for armor, artillery, aviation, support services, and joint Service requirements.

The obvious benefits are reduced cycle time to field new platforms through commonality and reuse, improved sustainment, and cost savings resulting from much larger production quantities. However, the soldier systems architecture helps us do more. For example, by using modular components, incorporating new commercial technology, and developing products via transformation-related research and development (R&D), we can more economically produce multiple platforms. This can be accomplished in parallel fielding events synchronized with the Army's Unit Set Fielding Plan.

User Involvement

User-needs generation is the initial step for developing the soldier systems architecture. For example, users are currently developing requirements in other combat domains including armor, aircraft, special operations, medicine, combat engineering, and artillery. Support-type requirements are also being developed for platforms in areas such as maintenance and logistics.

The soldier-as-a-system concept applies to user requirements as well. PM, Soldier Systems has been working with the U.S. Army Infantry Center as the lead proponent to coordinate the requirements definition process. The idea, illustrated in Figure 1, is that

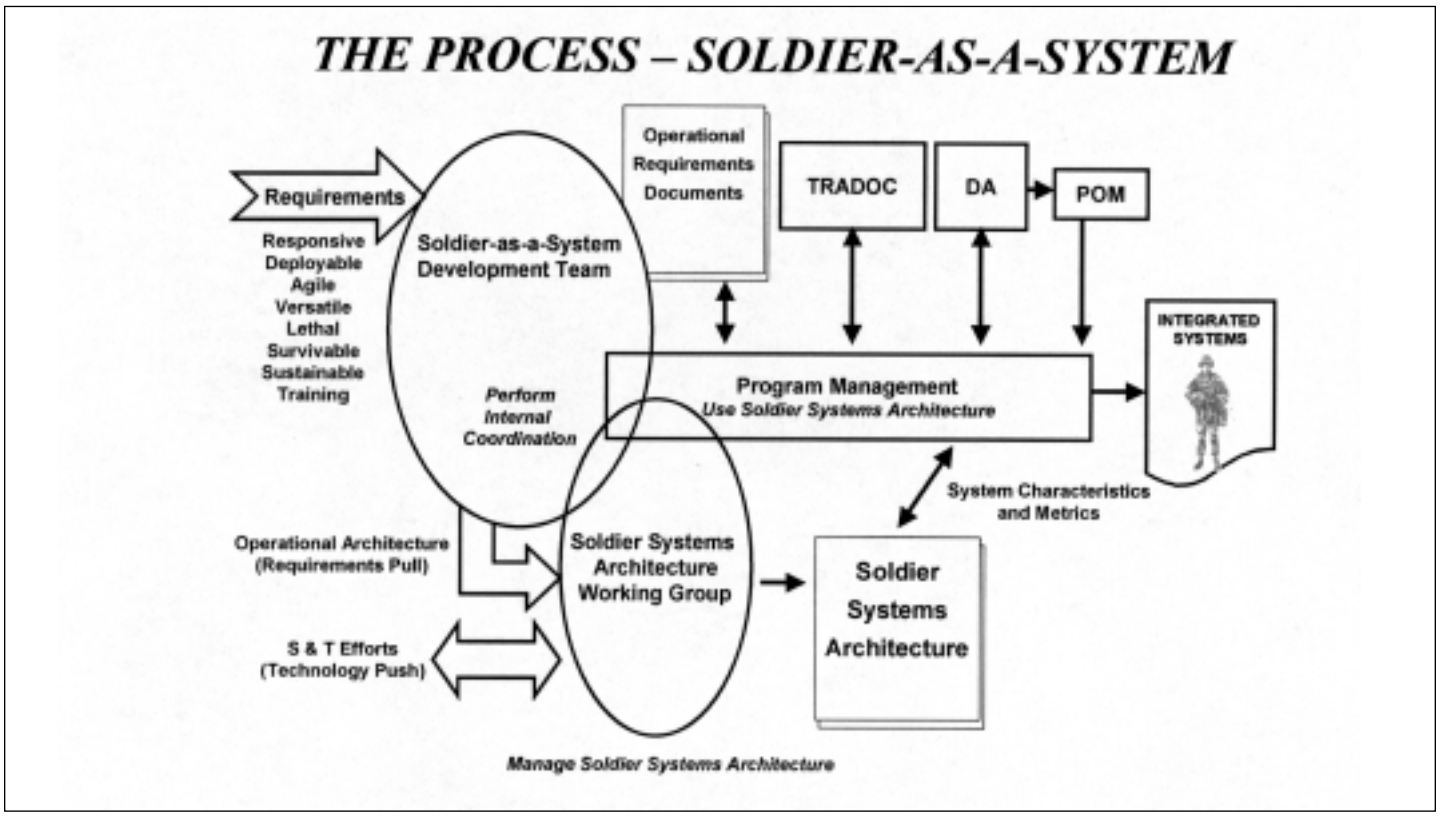

Figure 1.

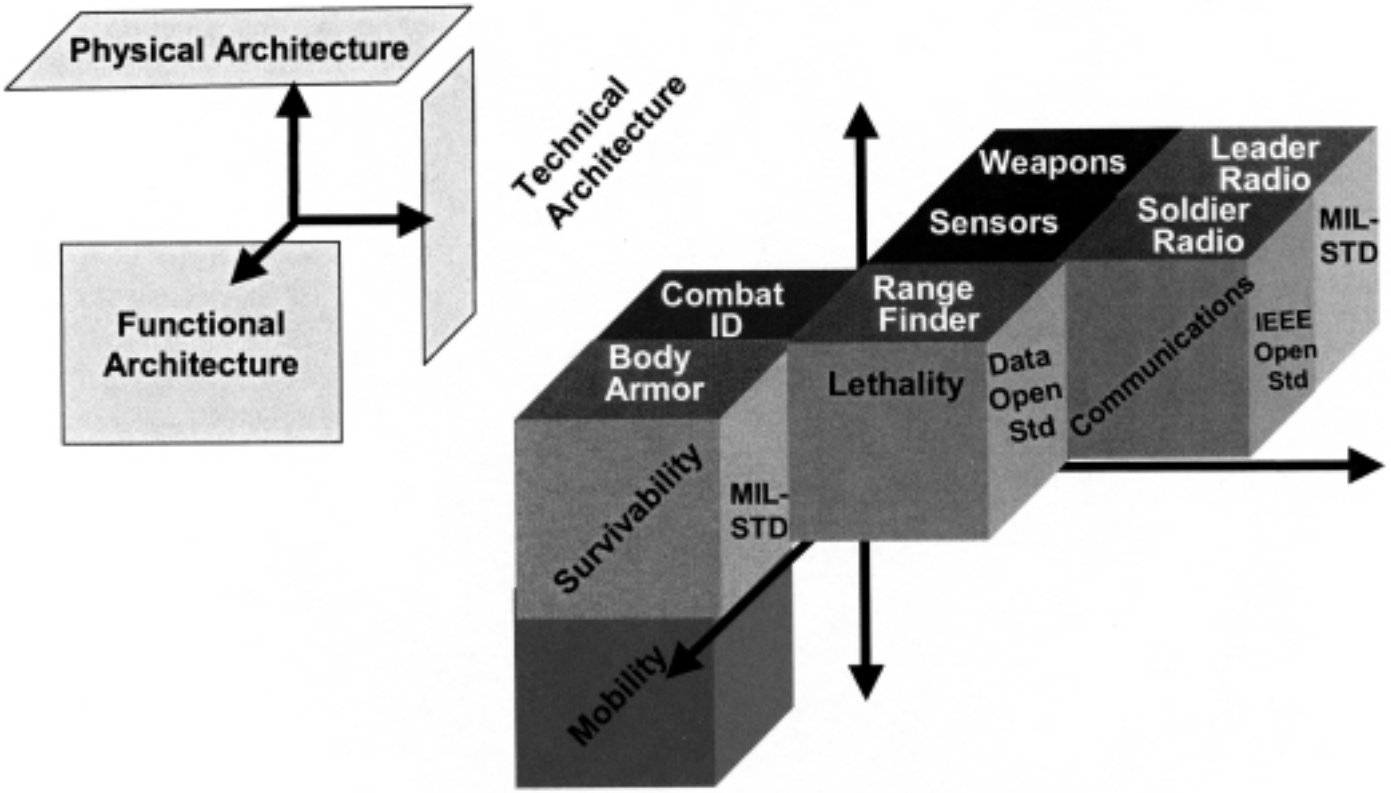

Figure 2.

materiel solution requirements can be handled much more efficiently when the users consider a core set of functions that are satisfied by modules currently in the soldier systems architecture. New capabilities build upon the basic functions, meaning development and production are only needed for the "delta" requirements. New solutions, in turn, update the architecture, providing an expanded basis for other platforms and subsequent systems.

The Soldier Systems Architecture Working Group interacts with the user community to establish and maintain the soldier systems architecture. The working group also provides a link to the R&D community to incorporate new technology developments into the architecture. The products of this process are the operational requirements document and the soldier systems architecture. Both will be used by the acquisition community when a new warrior platform is approved and funded.

Architectural Approach

The expandable soldier systems architecture facilitates plug-and-play functionality for sensors, weapons, electronics, and soldier equipment. It is the foundation for all warrior platform designs to satisfy a wide variety of soldier requirements. The architecture framework evolves more slowly than the solutions and the technology associated with individual modules. The framework includes open systems interfaces—widely available and consensus-based interface standards. Existing government items and legacy components use adapters to fit into the architecture when needed.

By concentrating on a modular architecture framework, the Army will develop warrior platforms that take advantage of future technology such as faster, low-power computer chips; improved materials; and new ballistic protection. Through close coordination with the R&D community and continuous market analysis of commercial technologies, we plan to leverage change as it occurs.

Soldier Systems Architecture

The soldier systems architecture of functions, modules, and interfaces is best viewed as a multidimensional figure. A portion is illustrated in Figure 2.

The user needs—functional architecture—are on the front face of each cube. The physical architecture—system modularity—can be related to each element of the functional architecture and is shown on the top of each cube. Corresponding technical architecture interfaces, on the right side of the cube, apply to every module. The horizontal plane forms the physical architecture, while the other two planes define the functional and technical architectures. The total three-dimensional representation is a soldier systems architecture that meets user requirements, incorporates modularity, and defines all interfaces.

The functional architecture identifies the requirements derived from the user. Managing a set of functions and their modular solutions allows us to minimize stovepiped development efforts for multiple systems, reduce procurement time through module reuse, and maintain common sustainment concepts.

The physical architecture includes all hardware and software components. The work breakdown structure captures physical architecture decisions. It defines the subsystems and major components that relate to user requirements in the functional architecture. Software modularity, part of this process, directly affects the complexity of future modifications and the software portability to multiple platforms. Logistics concepts, use of existing government or commercial items, and potential for reuse all affect module-partitioning decisions.

The technical architecture addresses interoperability among different platforms and systems. The joint technical architecture (JTA) and the JTA-Army (JTA-A) define a required set of interface standards and development guidelines for joint and Army programs that electronically produce, use, or exchange information.

The soldier systems technical architecture defines interfaces, both external and internal, that connect the system, subsystem modules, and in some cases, the internal components. The JTA provides choices for human-to-computer, data transfer, information processing, and information security activities. The soldier systems architecture takes these into account, but goes beyond information exchange. We are concerned with issues such as the following:

- Module interfaces on the soldier's load-carrying equipment,
- Sensor mounts on weapons,
- User interface controls,
- Common connectors,
- Standardized menu screens, and
- Adapters for legacy components and external systems.

We know that requirements will continue to evolve and expand. The soldier systems architecture is fundamental to implementing a responsive and effective acquisition process that must solve today's needs, but is flexible enough to cope with the future.

Architecture Coordination

We are employing the soldier systems architecture for warrior platforms now in development. The technical architecture interfaces form the framework and are key to the plug-and-play system evolution. Because other Army and government agencies develop equipment that is part of the physical architecture, coordination with these agencies and suppliers is important. For example, PM, Night Vision/Reconnaissance Surveillance and Target Acquisition continually develops new sensors with the potential for use on warrior platforms. If we intend to incorporate new night vision sensors, the plug-and-play concept only works when interfaces are consistent with the technical architecture. We cannot operate in a vacuum, but must be proactive, working with warrior platform users, government development agencies, and commercial suppliers.

Evolving Architecture

PM, Soldier Systems is now coordinating the technical architecture elements with interested Army and other government agencies. When the work is complete, we plan to update the soldier systems annex in the JTA-Army. The soldier systems architecture will eventually be fully coordinated and documented, but it will never be finished. We recognize that change will always be a factor. The functional architecture evolves each time there is a newly identified user requirement or new warrior platform. This drives re-evaluation of the physical architecture. Physical architecture changes, along with advances in technology and marketplace developments, will require us to re-examine the technical architecture in the future.

On the requirements side, PM, Soldier Systems and the Army Infantry Center are presenting a roadshow for users and developers. This explains the rationale and benefits for upfront requirements coordination and use of the architecture as a foundation for future platforms.

We know that requirements will continue to evolve and expand. The soldier systems architecture is fundamental to implementing a responsive and effective acquisition process that must solve today's needs, but is flexible enough to cope with the future. We expect that the interfaces will have much longer life spans than the materials, processes, and designs of system modules. However, the soldier systems architecture is not static, and the interactive user-developer management process will guide changes with time. This will help us define and develop new warrior platforms for the Interim Brigade Combat Teams and, ultimately, the Objective Force.

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